Energy Conversion and Management

an International Journal

Volume 37 1996

List of Contents and Author Index

Pergamon

ENERGY CONVERSION AND MANAGEMENT

Editor-in-Chief

DR JESSE C. DENTON
P.O. Box 355, Belton, TX 76513, U.S.A.

Editorial Assistant ELIZABETH DENTON

Regional Editors

PROFESSOR NOAM LIOR
212 Towne Building
University of Pennsylvania
Philadelphia, PA 19104-6315, U.S.A.

PROFESSOR EMERITUS TOKIO OHTA
Yokohama National University
4-8-15 Inamuragasaki
Kamakura, Japan 248

Editorial Board

PROFESSOR A. JOHN APPLEBY
Director, Center for
Electrochemical Systems
& Hydrogen Research
238 Wisenbaker Engineering
Research Center
The Texas A&M University
System, College Station
TX 77843-3042, U.S.A.

DR KARL W. BOER
Solar Knoll
239 Bucktoe Hills Road
Kennett Square
PA 19348, U.S.A.

PROFESSOR GEORGE TSATSARONIS
Institute of Energy Engineering
Technische Universität Berlin
Marchstr. 18, 10587
Berlin, Germany

PROFESSOR R. W. J. KOUFFELD
Faculty of Mechanical Engineering
and Marine Technology
Mekelweg 2, P.O. Box 5037
2600 GA Delft
The Netherlands

PROFESSOR CHIH WU
Mechanical Engineering
Department
U.S. Naval Academy
Annapolis
MD 21402-5042, U.S.A.

DR RICHARD J. ROSA
Mechanical Engineering
Department
Montana State University
Bozeman, MT 59715
U.S.A.

Publishing Office: Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. [*Tel.* (01865) 843740; *Fax* (01865) 843969]

Production Editor: Jackie Bannister (*E-mail:* j.bannister@elsevier.co.uk)

Subscription and Advertising Offices: North America: Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A. Rest of the World: Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. [*Tel.* (01865) 843000; *Fax* (01865) 843010]

Frequency: Published 18 times per year

Subscription Rates: Annual Institutional Subscription Rates 1997 (Provisional): North, Central and South America, US$1838; Rest of the World £1145. Associated Personal Subscription Rates are available on request for those whose institutions are library subscribers. Sterling prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice.

Back Issues: Back issues of all previously published volumes are available direct from Elsevier Science Offices (Oxford and New York). Complete volumes and single issues can be purchased for 1991–1996. Earlier issues are available in high quality photo-duplicated copies as complete volumes only.

Periodicals postage paid at Newark, New Jersey. *Energy Conversion and Management* (ISSN 0196-8904) is published monthly, January to December plus additional issues in January, March, May, July, September and November by Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, U.K. The annual subscription in the U.S.A. is $1838. *Energy Conversion and Management* is distributed by Mercury Airfreight International Ltd, 10 Camptown Road, Irvington, NJ 07111-1105. POSTMASTER: please send address corrections to *Energy Conversion and Management*, c/o Elsevier Science Inc., 660 White Plains Road, Tarrytown, NY 10591-5153, U.S.A.

CONTENTS OF VOLUME 37

Number 1

A. THOMAS	1	Design methodology for a small solar steam generation system using the flash boiler concept
JINCAN CHEN, CHIH WU and R. L. KIANG	17	Maximum specific power output of an irreversible radiant heat engine
M. A. AL-NIMR, M. K. ABU-QUDAIS and M. D. MASHAQI	23	Dynamic behaviour of a packed bed energy storage system
MOTOO ISHIKAWA, AKIHIRO KYOGOKU and JURO UMOTO	31	Stability of large-scale MHD channels designed for coal-fired MHD power generation
A. CHANDRA and B. S. BHADORIA	43	MHD retrofit channel with diagonal electrode geometry: parametric investigation
IBRAHIM DINCER, MUSTAFA EDIN and I. ENGIN TURE	51	Investigation of thermal performance of a solar powered absorption refrigeration system
DAVID A. BLANK and CHIH WU	59	Power limit of an endoreversible Ericsson cycle with regeneration
I. A. HASSANIEN, H. M. EL-HAWARY and A. A. SALAMA	67	Chebyshev solution of axisymmetric stagnation flow on a cylinder
N. M. NAHAR, J. P. GUPTA and P. SHARMA	77	A novel solar cooker for animal feed
M. AZZAM and M. ABDUL-SADEK NOUR	81	An expert system for voltage control of a large-scale power system
KRISHNENDU DAS and A. MANI	87	Comparative study of cycle performance for a two stage intermittent solar refrigerator working with R22-absorbent combinations
C. CHOUDHURY, P. M. CHAUHAN, H. P. GARG and S. N. GARG	95	Cost–benefit ratio of triple pass solar air heaters
B. SUDHAKARA REDDY	117	Modelling of competing technologies in the residential sector

Number 2

AGHAREED M. TAYEB	127	Use of some industrial wastes as energy storage media
C. D. RAKOPOULOS and D. T. HOUNTALAS	135	A simulation analysis of a DI diesel engine fuel injection system fitted with a constant pressure valve
V. BADESCU	151	Optimum design and operation of a dynamic solar power system

S. CHIRATTANANON and Z. GAO — 161 — A model for the performance evaluation of the operation of electric arc furnace

E. EL-MADBOULY and M. ABDUL-SADEK NOUR — 167 — On the evaluation of control systems

IBRAHIM DINCER, SUKRAN DILMAC, I. ENGIN TURE and MUSTAFA EDIN — 183 — A simple technique for estimating solar radiation parameters and its application for Gebze

G. N. TIWARI, J. A. USMANI and A. CHANDRA — 199 — Determination of period for biogas production

A. AHMAD, J. S. SAINI and H. K. VARMA — 205 — Thermohydraulic performance of packed-bed solar air heaters

A. THOMAS — 215 — Solar steam generating systems using parabolic trough concentrators

S. K. SINGH, V. P. BHATNAGAR and G. N. TIWARI — 247 — Design parameters for concentrator assisted solar distillation system

Number 3

N. A. MOSTAFA — 253 — Production of lactic acid from whey with agar immobilized cells in a continuous packed tubular reactor

H. Ö. PAKSOY — 261 — Determining thermal properties of heat storage materials using the twin bath method

H. SOFRATA — 269 — Heat rejection alternatives for thermoelectric refrigerators

NORMAN F. BESSETTE II and WILLIAM J. WEPFER — 281 — Prediction of on-design and off-design performance for a solid oxide fuel cell power module

M. NAKAIWA, T. AKIYA, M. OWA and Y. TANAKA — 295 — Evaluation of an energy supply system with air separation

A. K. BİNARK and N. TÜRKMEN — 303 — Modelling of a hot box solar cooker

A. CHANDRA, B. S. BHADORIA and S. S. VERMA — 311 — Performance of a MHD retrofit channel with diagonal electrode geometry

G. THOMAS BELLARMINE and N. S. S. AROKIASWAMY — 319 — Energy management techniques to meet power shortage problems in India

SURENDRA SINGH, I. P. SINGH, SARJINDER SINGH and C. J. S. PANNU — 329 — Energy planning of a Punjab village using multiple objectives compromise programming

JOSEPH C. LAM and DANNY H. W. LI — 343 — Study of solar radiation data for Hong Kong

JINCAN CHEN and CHIH WU — 353 — Optimization of a two-stage combined refrigeration system

M. A. ROSEN — 359 — Comparative assessment of thermodynamic efficiencies and losses for natural gas-based production processes for hydrogen, ammonia and methanol

M. A. R. EISA — 369 — Applications of heat pumps in chemical processing

Number 4

O. A. HAMED, A. M. ZAMAMIRI, S. ALY and N. LIOR — 379 — Thermal performance and exergy analysis of a thermal vapor compression desalination system

ALEX H. W. LEE and JEROLD W. JONES — 389 — Thermal performance of a residential desuperheater/water heater system

YOUSEF S. H. NAJJAR and MAHMOUD S. ZAAMOUT — 399 — Performance analysis of gas turbine air-bottoming combined system

A. I. KUDISH and A. IANETZ — 405 — Analysis of daily clearness index, global and beam radiation for Beer Sheva, Israel: partition according to day type and statistical analysis

SUDHA SINGH and S. K. SINGH — 417 — Effect of cupric nitrate on acceleration of biogas production

SAGHIRUDDIN and M. ALTAMUSH SIDDIQUI — 421 — Economic analyses and performance study of three ammonia-absorption cycles using heat recovery absorber

I. H. MALIK and M. ALTAMUSH SIDDIQUI — 433 — Optimization of generator temperatures in the heat operated absorption cycle using four types of aqueous salt solutions

A. KARAGIANNIDIS — 447 — Burners of domestic heating boilers: a measurement-based analysis approach aiming at quantifying correlations among the basic parameters of operation

K. FATHALAH and S. E. ALY — 457 — Study of a waste heat driven modified packed desiccant bed dehumidifier

V. K. SRIVASTAVA, SUSHIL and R. K. JALAN — 473 — Prediction of concentration in the pyrolysis of biomass material—II

Y. SHINDO, K. SAKAKI, Y. FUJIOKA and H. KOMIYAMA — 485 — Kinetics of the formation of CO_2 hydrate on the surface of liquid CO_2 droplet in water

MANFRED FEHR — 491 — An integrated information management network

I. P. S. PAUL, S. P. SABBERWAL and S. C. KAUSHIK — 495 — Optimum economy and efficiency in energy consumption during start-up and shut-down of 210 MW thermal power stations

O. P. SINGH, S. K. SRIVASTAVA and A. GAUR — 501 — Empirical relationship to estimate global radiation from hours of sunshine

Number 5

SEYHAN UYGUR and NILÜFER EĞRICAN — 505 — Modeling of natural turbulent flow in a passively heated zone

J. C. Ododo and A. Usman — 521 Correlation of total solar radiation with common meteorological parameters for Yola and Calabar, Nigeria

A. K. Singh, G. N. Tiwari, N. Lugani and H. P. Garg — 531 Energy conservation in a cinema hall under hot and dry condition

S. C. Tripathy — 541 A method for digital governor analysis

Lin Wenxian, Lu Enrong, Gao Wenfeng, Pu Shaoxuan and Liu Tao — 553 Distribution patterns of diffuse solar radiation in Yunnan Province, China

Lin Wenxian, Liu Tao, Pu Shaoxuan, Gao Wenfeng and Lu Enrong — 561 Estimation and distribution patterns of direct solar radiation in Yunnan Province, China

V. R. Malghan — 569 History of MHD power plant development

Rasim Karabacak — 591 Experimental relationships for heat flux, Nusselt number and temperature difference in a finned heater

P. Brousseau and M. Lacroix — 599 Study of the thermal performance of a multi-layer PCM storage unit

R. Aburas, M. A. Hammad, S. E. Hiary, S. Qousous and I. Abu-reesh — 611 Construction and operation of a demonstration biogas plant, problems and prospects

J. Mumba — 615 Design and development of a solar grain dryer incorporating photovoltaic powered air circulation

N. Chaturvedi — 623 On MHD flow past an infinite porous plate with variable suction

Sanjay Kumar and S. Sinha — 629 Transient model and comparative study of concentrator coupled regenerative solar still in forced circulation mode

D. Buddhi and V. V. S. Murthy — 637 Comparison of using thermocouple and optical fibre to study the solid–liquid boundary in phase change materials

Number 6–8

PROCEEDINGS OF THE INTERNATIONAL ENERGY AGENCY GREENHOUSE GASES: MITIGATION OPTIONS CONFERENCE

P. W. F. Riemer — 641 Introduction

J. V. Mitchell — 643 The politics of the Greenhouse

PLENARY SESSION

P. Freund — 647 The IEA greenhouse gas R&D programme

H. J. Koch — 653 Initiatives to respond to climate change concerns

J. TILLEY 659 Collaboration on technology development—The IEA/OECD technology scoping study

SESSION 1. INTERNATIONAL DIMENSIONS I

P. RIEMER 665 Greenhouse gas mitigation technologies, an overview of the CO_2 capture, storage and future activities of the IEA greenhouse gas R&D programme

A. F. ARMOR and G. T. PRESTON 671 The impact of fossil generation advances on the emissions of CO_2 in the United States

Y. KAYA, M. TAMAKI, K. YAMAGISHI and I. HAYASHI 679 Japan's strategy in technology development for mitigating global warming

R. A. DURIE, H. SCHAAP, J. H. EDWARDS and A. EKSTROM 685 Greenhouse gas issues and mitigation initiatives in Australia—An overview

B. SØRENSEN 693 Scenarios for greenhouse warming mitigation

A. J. VAN DEN BERG 699 Envirotech investment fund: an innovative financial approach to greenhouse gas reduction

W. HENNESSY, R. MILLS and R. WHITNEY 703 New Zealand's unique blend of emissions mitigation and sinks enhancement policies

J. H. WALSH 709 A simple spreadsheet for the assessment of options for the mitigation of world carbon dioxide emissions

M. VAN WEES and A. VAN WIJK 717 The assessment of the long-term prospects of energy technologies in the Netherlands

SESSION 2. INTERNATIONAL DIMENSIONS II

C. W. A. EVERS 723 Emissions of greenhouse gases in the Netherlands

C. HENDRIKS and K. BLOK 729 Regulation for combined heat and power in the European Union

S. MOLT, P. SCHAUMANN, E. LAEGE, U. FAHL and A. VOSS 735 Integrated strategies to reduce greenhouse gas emissions in Germany

I. LOWE 741 Greenhouse gas mitigation: policy options

S. B. ALPERT and J. MAULBETSCH 747 Global warming mitigation strategies

SESSION 3. INTERNATIONAL DIMENSIONS III

W. RUIJGROK 751 Targets for mitigation of greenhouse gases—Implications from a long-term perspective

M. A. V. DE FREITAS and L. P. ROSA 757 Strategies for reducing carbon emissions on the tropical rain forest: the case of the Brazilian Amazon

K. YA. KONDRATYEV 763 Greenhouse warming versus aerosol cooling in the context of global climate change

SESSION 4. INTERNATIONAL DIMENSIONS: EMISSIONS I

D. Fowler, K. J. Hargreaves, T. W. Choularton, M. W. Gallagher, T. Simpson and A. Kaye — 769 — Measurements of regional CH_4 emissions in the UK using boundary layer budget methods

P. Markewitz, W. Kuckshinrichs, D. Martinsen and J.-Fr. Hake — 777 — IKARUS—A fundamental concept for national GHG-mitigation strategies

J.-P. Fontelle — 783 — Greenhouse gas emission inventories in Europe—CORINAIR 90 and 94

SESSION 5. MITIGATION OF METHANE EMISSIONS I

P. C. Thakur, H. G. Little and W. G. Karis — 789 — Global coalbed methane recovery and use

S. Shimada, K. Ohga and G. Deguchi — 795 — Technologies recovering and utilizing coal seam gas in Japan

P. Jackson and S. Kershaw — 801 — Reducing long term methane emissions resulting from coal mining

D. Brenkley and S. C. Bennett — 807 — An integrated approach to coal measure methane estimation, recovery and utilisation

SESSION 6. FULL FUEL & LIFE CYCLE STUDIES I

B. Schlamadinger and G. Marland — 813 — Full fuel cycle carbon balances of bioenergy and forestry options

M. R. Holland, N. J. Eyre and T. E. Downing — 819 — Assessment of the costs of global warming on a full fuel cycle basis

C. Hope — 825 — Uncertainty in full fuel cycle costs

E. Nieuwlaar, E. Alsema and B. van Engelenburg — 831 — Using life-cycle assessments for the environmental evaluation of greenhouse gas mitigation options

H. Audus — 837 — IEA greenhouse gas R&D programme: full fuel cycle studies

SESSION 7. ADVANCED TECHNOLOGIES I

M. Steinberg — 843 — The Carnol process for CO_2 mitigation from power plants and the transportation sector

P. G. Alfredson — 849 — The Australian cooperative research centre for black coal utilisation—Potential for reduced greenhouse gas emissions through improved efficiencies

J. Andries and J. G. M. Becht — 855 — Pressurized fluidized bed gasification of coal using flue gas recirculation and oxygen injection

S. N. Barker — 861 — Gasification and pyrolysis—Routes to competitive electricity production from biomass in the UK

E. I. YANTOVSKI 867 Stack downward—Zero emission fuel-fired power plants concept

SESSION 8. ADVANCED TECHNOLOGIES II

A. J. VAN DEN BERG 879 Truckstop electrification: reducing CO_2 emissions from mobile sources while they are stationary

A. CHAMBERLAND and S. LEVESQUE 885 Hydroelectricity, an option to reduce greenhouse gas emissions from thermal power plants

C. MADEN and T. MOLE 891 Nuclear energy: an option to keep open?

S. KJÆR 897 Status and future of advanced PF power plants

Y. SHAO and D. GOLOMB 903 Power plants with CO_2 capture using integrated air separation and flue gas recycling

A. D. RAO and W. H. DAY 909 Mitigation of greenhouse gases from gas turbine power plants

SESSION 9. CARBON DIOXIDE CAPTURE

C. L. LECI 915 Financial implications on power generation costs resulting from the parasitic effect of CO_2 capture using liquid scrubbing technology from power station flue gases

L. DRAGOS, O. NADA, C. FLUERARU and N. SCARLAT 923 Romanian researches for CO_2 recovery

M. ISHIBASHI, H. OTA, N. AKUTSU, S. UMEDA, M. TAJIKA, J. IZUMI, A. YASUTAKE, T. KABATA and Y. KAGEYAMA 929 Technology for removing carbon dioxide from power plant flue gas by the physical adsorption method

P. TONTIWACHWUTHIKUL 935 Research and development activities on high efficiency separation process technologies for carbon dioxide removal from industrial sources at University of Regina, Canada

C. W. CHAN and P. TONTIWACHWUTHIKUL 941 A decision support system for solvent selection of CO_2 separation processes

T. D. BURCHELL and R. R. JUDKINS 947 Passive CO_2 removal using a carbon fiber composite molecular sieve

R. SCHAEFFER and A. L. DE SÁ 955 The embodiment of carbon associated with Brazilian imports and exports

SESSION 10. INTERNATIONAL DIMENSIONS: EMISSIONS II

A. E. HACKL 961 Mitigation strategies for greenhouse gases in Austria

M. CHWALOWSKI 967 Electric technologies and CO_2: problem or solution

F. KRAUSE and J. KOOMEY 973 The cost of cutting carbon emissions—A case study of Western Europe

R. HETHERINGTON 979 An input–output analysis of carbon dioxide emissions for the UK

H. OONK 985 Dutch abiogenic emissions of methane and nitrous oxide and options for emission reduction

A. BANDO 991 Strategic planning and adoption of greenhouse gas mitigation options in Asia

SESSION 11. CARBON DIOXIDE STORAGE—OCEANS I

H. J. HERZOG, E. E. ADAMS, D. AUERBACH and J. CAULFIELD 999 Environmental impacts of ocean disposal of CO_2

C. S. WONG and R. J. MATEAR 1007 Effects of circulation and mixing on the disposal of CO_2 in the North Pacific

H. KRUSE and M. TEKIELA 1013 Calculating the consequences of a CO_2-pipeline rupture

P. M. HAUGAN and H. DRANGE 1019 Effects of CO_2 on the ocean environment

N. NAKASHIKI, D. TSUMUNE and T. HIKITA 1023 Effectiveness of ocean intermediate depth injection (Part 2)

H. TENG, S. M. MASUTANI, C. M. KINOSHITA and G. C. NIHOUS 1029 Solubility of CO_2 in the ocean and its effect on CO_2 dissolution

SESSION 12. CARBON DIOXIDE STORAGE—OCEANS II

G. C. NIHOUS, S. M. MASUTANI, L. A. VEGA and C. M. KINOSHITA 1039 Preliminary assessment of the potential coupling between atmospheric temperature and CO_2 concentration via ocean water overturning

I. S. F. JONES 1049 Enhanced carbon dioxide uptake by the World's oceans

P. GUEVEL, D. H. FRUMAN and N. MURRAY 1053 Conceptual design of an integrated solid CO_2 penetrator marine disposal system

H. A. HAUGEN and L. I. EIDE 1061 CO_2 capture and disposal: the realism of large scale scenarios

C. N. MURRAY, L. VISINTINI, G. BIDOGLIO and B. HENRY 1067 Permanent storage of carbon dioxide in the marine environment: the solid CO_2 penetrator

S. HIRAI, K. OKAZAKI, N. ARAKI, H. YAZAWA, H. ITO and K. HIJIKATA 1073 Transport phenomena of liquid CO_2 in pressurized water flow with clathrate-hydrate at the interface

R. B. BACASTOW and R. K. DEWEY 1079 Effectiveness of CO_2 sequestration in the post-industrial ocean

S. HIRAI, K. OKAZAKI, S. KURAOKA and K. KAWAMURA 1087 Study for the stability of CO_2 clathrate-hydrate using molecular dynamics simulation

SESSION 13. MITIGATION OF METHANE EMISSIONS II

B. W. MOSHER, P. C. CZEPIEL, J. SHORTER, E. ALLWINE, R. C. HARRISS, C. KOLB and B. LAMB 1093 Mitigation of methane emissions at landfill sites in New England, USA

M. MEADOWS 1099 Estimating landfill methane emissions

R. PIPATTI and I. SAVOLAINEN 1105 Role of energy production in the control of greenhouse gas emissions from waste management

E. AITCHISON 1111 Methane generation from UK landfill sites and its use as an energy resource

S. AUMONIER 1117 The greenhouse gas consequences of waste management—Identifying preferred options

SESSION 14. CARBON DIOXIDE STORAGE—UNDERGROUND

J. M. PEARCE, S. HOLLOWAY, H. WACKER, M. K. NELIS, C. ROCHELLE and K. BATEMAN 1123 Natural occurrences as analogues for the geological disposal of carbon dioxide

P. TONTIWACHWUTHIKUL, C. W. CHAN, W. KRITPIPHAT, D. SKOROPAD, D. GELOWITZ, A. AROONWILAS, C. JORDAN, F. MOURITS, M. WILSON and L. WARD 1129 New feasibility study of carbon dioxide production from coal-fired power plants for enhanced oil recovery: a Canadian perspective

W. D. GUNTER, S. BACHU, D. H.-S. LAW, V. MARWAHA, D. L. DRYSDALE, D. E. MACDONALD and T. J. MCCANN 1135 Technical and economic feasibility of CO_2 disposal in aquifers within the Alberta sedimentary basin, Canada

A. S. KELEBEEV, N. N. AKINFIEV and V. M. SHVETS 1143 Carbon dioxide utilization in aquifer: method for mitigation greenhouse effect

S. HOLLOWAY 1149 An overview of the Joule II project 'The underground disposal of carbon dioxide'

L. G. H. VAN DER MEER 1155 Computer modelling of underground CO_2 storage

K. H. IPSEN and F. L. JACOBSEN 1161 The Linde Structure, Denmark an example of a CO_2-depository with a secondary chalk cap rock

D. H.-S. LAW and S. BACHU 1167 Hydrogeological and numerical analysis of CO_2 disposal in deep aquifers in the Alberta sedimentary basin

SESSION 15. MITIGATION OF METHANE EMISSIONS III

B. D. BANERJEE and B. B. DHAR 1175 Issues and options for reducing methane emission to the atmosphere from Indian coal mining

D. DE JAGER and K. BLOK 1181 Cost-effectiveness of emission-reducing measures for methane in the Netherlands

B. OUDART 1187 Strategies for limiting methane gas in the European Union

E. FABER, U. BERNER, P. GERLING, A. HOLLERBACH, W. J. STAHL and H. G. SCHRÖDER 1193 Isotopic tracing of methane in water and exchange with the atmosphere

SESSION 16. BIOMASS OPTIONS

N. GOTO and Y. YANAGISAWA 1199 Assessment of CO_2 reduction by technological usage of terrestrial ecosystems—Reforestation and biomass energy

J. G. CLELAND and C. R. PURVIS 1205 Independent power plant using wood waste

L. GUSTAVSSON and P. SVENNINGSSON 1211 Substituting fossil fuels with biomass

M. WIHERSAARI 1217 Energy consumption and greenhouse gas emissions from biomass production chains

F. BOHLIN and L. O. ERIKSSON 1223 Evaluation criteria for carbon dioxide mitigating projects in forestry and agriculture

A. R. BRAUN 1229 Re-use and fixation of CO_2 in chemistry, algal biomass and fuel substitutions in the traffic sector

P. I. I. BÖRJESSON 1235 Emissions of CO_2 from biomass production and transportation in agriculture and forestry

SESSION 17. FULL FUEL & LIFE CYCLE STUDIES II

L. SAROFF 1241 Coal fuel cycle externalities estimates (Part of the U.S. initiative of the U.S. DOE/CEC Study)

H. KOMIYAMA, K. YAMADA, A. INABA and K. KATO 1247 Life cycle analysis of solar cell systems as a means to reduce atmospheric carbon dioxide emissions

R. MATSUHASHI, K. HIKITA and H. ISHITANI 1253 Model analyses for sustainable energy supply taking resource and environmental constraints into consideration

M. CHWALOWSKI 1259 Critical questions about the full fuel cycle analysis

K. S. DEMIRCHIAN and K. K. DEMIRCHIAN 1265 A simple model of carbon cycle for upgrading global fossil fuels consumption and carbon emission forecasts validity

SESSION 18. NITROUS OXIDE

D. BOAVIDA, I. GULYURTLU, L. S. LOBO and I. CABRITA 1271 N_2O formation during coal combustion in fluidised beds—Is it controlled by homogeneous or heterogeneous reactions?

A. VERMOESEN, O. VAN CLEEMPUT and G. HOFMAN 1279 Long-term measurements of N_2O emissions

Y. SUZUKI, H. MORITOMI and H. TANAKA 1285 Reduction of N_2O emissions from circulating fluidized bed combustors by injection of fuel gases and changing of coal feed point

G. LATINI, G. PASSERINI and F. POLONARA 1291 Thermophysical properties of greenhouse gases thermal conductivity and dynamic viscosity as function of temperature and pressure

A. LYNGFELT, L.-E. ÅMAND, L. GUSTAVSSON and B. LECKNER 1297 Methods for reducing the emission of nitrous oxide from fluidized bed combustion

U. SKIBA, I. P. MCTAGGART, K. A. SMITH, K. J. HARGREAVES and D. FOWLER 1303 Estimates of nitrous oxide emissions from soil in the UK

R. ORTHOFER, H. M. KNOFLACHER and J. ZUEGER 1309 Nitrous oxide emissions in Austria

SESSION 19. CARBON DIOXIDE UTILISATION OPTIONS I

M. TSUJI, Y. WADA, Y. TAMAURA, A. STEINFELD, P. KUHN and R. PALUMBO 1315 Coal gasification by the coal/CH_4-ZnO-Zn-H_2O solar energy conversion system

Y. WATANABE and D. O. HALL 1321 Photosynthetic CO_2 conversion technologies using a photobioreactor incorporating microalgae—Energy and material balances

A. STEINFELD, P. KUHN and Y. TAMAURA 1327 CH_4-utilization and CO_2-mitigation in the metallurgical industry via solar thermochemistry

N. HASEGAWA, T. YOSHIDA, M. TSUJI and Y. TAMAURA 1333 Integrated carbon recycling system for mitigation of CO_2 emissions utilizing degraded thermal energy

J. H. EDWARDS, K. T. DO, A. M. MAITRA, S. SCHUCK, W. FOK and W. STEIN 1339 The use of solar-based CO_2/CH_4 reforming for reducing greenhouse gas emissions during the generation of electricity and process heat

SESSION 20. CARBON DIOXIDE UTILISATION OPTIONS II

M. A. MALATI 1345 Mitigation of CO_2 greenhouse effect. Combined disposal and utilisation by photocatalysis

T. WEIMER, K. SCHABER, M. SPECHT and A. BANDI 1351 Methanol from atmospheric carbon dioxide: a liquid zero emission fuel for the future

CHANG-YOU WANG, SHU-YING LI, XUE-REN YANG, JIE REN and YANG-GUANG CHEN 1357 CH_4–CO_2 reforming anti-carbon deposition catalyst

L. M. BROWN 1363 Uptake of carbon dioxide from flue gas by microalgae

P. FREUND 1369 Summary and closing remarks

Number 9

P. R. MISHRA and J. C. JOSHI — 1371 — Reliability estimation for components of photovoltaic systems

MOHAMAD ABU-QUDAIS — 1383 — Exhaust gas temperature for knock detection and control in spark ignition engine

RAJKA BUDIN, ALKA MIHELIĆ-BOGDANIĆ and VELJKO FILIPAN — 1393 — Energy conservation using a recuperative drying process

JINCAN CHEN and CHIH WU — 1401 — General performance characteristics of an n-stage endoreversible combined power cycle system at maximum specific power output

HAMID M. B. METWALLY and WAGDY R. ANIS — 1407 — Dynamic performance of directly coupled photovoltaic water pumping system using D.C. shunt motor

M. TIRIS, Ç. TIRIS and İ. E. TÜRE — 1417 — Correlations of monthly-average daily global, diffuse and beam radiations with hours of bright sunshine in Gebze, Turkey

J. A. USMANI, G. N. TIWARI and A. CHANDRA — 1423 — Performance characteristic of a greenhouse integrated biogas system

SANGHO CHOI and MONCEF KRARTI — 1435 — Slab heat loss calculation with non-uniform inside air temperature profiles

A. KERIM KAR and ÜMIT KAR — 1445 — Optimum design and selection of residential storage-type electric water heaters for energy conservation

N. ESKIN and A. KILIC — 1453 — Estimation of cooling tube location in fluidized bed coal combustors through exergy analysis

T. MUNEER and B. HAN — 1463 — Simplified analysis for free convection in enclosures—application to an industrial problem

MORTEZA M. ARDEHALI and THEODORE F. SMITH — 1469 — Evaluation of variable volume and temperature HVAC system for commercial and residential buildings

Number 10

C. M. JEFFERSON and M. ACKERMAN — 1481 — A flywheel variator energy storage system

ALEX H. W. LEE and JEROLD W. JONES — 1493 — Modeling of an ice-on-coil thermal energy storage system

CHIH WU — 1509 — Performance of an endoreversible Carnot refrigerator

CHIH WU — 1513 — Heat exchanger effect on a gas refrigeration cycle

F. Bruno, S. De Maria and W. Saman — 1517 — Analysis of the operation of a high-pressure micro-compressor

Ji-Qin Ni and Edmond-Jacques Nyns — 1525 — New concept for the evaluation of rural biogas management in developing countries

Surendra B. Prasad — 1535 — Modelling a charcoal production system fired by the exhaust of a diesel engine

Surendra Singh, Sarjinder Singh, C. J. S. Pannu and J. P. Mittal — 1547 — Fertilizer energy use and crop yield relationships for wheat in the Punjab ecosystems

J. C. Ododo, J. A. Agbakwuru and F. A. Ogbu — 1555 — Correlation of solar radiation with cloud cover and relative sunshine duration

Moncef Krarti and Jan F. Kreider — 1561 — Analytical model for heat transfer in an underground air tunnel

Number 11

Abdel-Salam Hafiz A. Hamza — 1575 — Investigations of switching operations on composite feeders

Abdel-Salam H. A. Hamza and Nagat M. K. Abdel-Gawad — 1589 — Digital computer computation and analysis of gas insulated substation overvoltages

Ibrahim Dincer — 1601 — A model to determine film coefficients for spherical objects during cooling

E. Rogdakis and A. Stegou-Sagia — 1609 — Neutral gas absorption refrigeration units with methyl amine as refrigerant and hydrogen as inert gas

M. Chandra — 1623 — Luminous efficacy of solar radiation and evaluation of natural illumination—a review

S. C. Tripathy and V. Bhardwaj — 1635 — Automatic generation control of a small hydro-turbine driven generator

Bhagwan Prasad and G. N. Tiwari — 1647 — Analysis of double effect active solar distillation

K. Sopian, K. S. Yigit, H. T. Liu, S. Kakaç and T. N. Veziroglu — 1657 — Performance analysis of photovoltaic thermal air heaters

Chih Wu, Lingen Chen and Fengrui Sun — 1671 — Performance analysis of solar three-heat-reservoir cooling systems

Number 12

M. A. K. Lodhi — 1677 — Solar ponds in alkaline lake and oil well regions

M. Hammad and T. Khatib — 1695 — Energy parameters of a solar car for Jordan

Joseph C. Lam and Danny H. W. Li	1703	Luminous efficacy of daylight under different sky conditions
Yousef S. H. Najjar	1713	Some trends and progress in gas turbine technology and research
Fredrik Bertilsson and Hans T. Karlsson	1725	CO_2 utilization options, Part I: An emission assessment framework
Fredrik Bertilsson and Hans T. Karlsson	1733	CO_2 utilization options, Part II: Assessment of dimethyl carbonate production
G. Thomas Bellarmine and Joe Urquhart	1741	Wind energy for the 1990s and beyond
Valentina S. Bajović	1753	A reliable tool for the design of shape and size of Faraday segmented MHD generator channel
Y. Inui, N. Emoto, M. Ishikawa and J. Umoto	1765	Conceptual design of coupled nonequilibrium disk MHD generator and superconducting magnet system
Mehmet Esen and Teoman Ayhan	1775	Development of a model compatible with solar assisted cylindrical energy storage tank and variation of stored energy with time for different phase change materials
S. C. Tripathy and I. P. Mishra	1787	Dynamic performance of wind-Diesel power system with capacitive energy storage